

ESEIAAT  
MASTER'S THESIS



Escola Superior d'Enginyeries Industrials,  
Aeroespacial i Audiovisual de Terrassa

UNIVERSITAT POLITÈCNICA DE CATALUNYA

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## Study, implementation and test of a solid propellant rocket motor

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*BUDGET*

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Contents

1. Labour costs..... 4

2. Materials, tools and services costs ..... 5

3. Energy costs..... 6

4. Final costs ..... 7

References ..... 8

## List of tables

Table 1: Final costs of the thesis.....	7
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### 1. Labour costs

The work done by the engineer in charge of designing the motor is not free. The hourly price of the worker will be set at 15 €/hour when working on the computer during the design, organisation and miscellaneous development of the thesis, while the price of the worker working in the manufacture of the prototype will be set at 12 €/hour. The time invested in the design and documental phase of the thesis has been about 300 hours. Regarding the hours invested in the fabrication of the prototype, they have been used in the following activities:

- Nozzle machining: 6 hours.
- Nozzle cap machining: 4 hours.
- Top cap machining: 3 hours.
- Casing machining: 0.5 hours.
- Cap-fixing screws: 4 hours.

This gives a total of 17.5 *hours* of work. So the total cost of the labour has been:

$$\textbf{Labour cost} = 300 [\textit{hours}] \times 15\text{€/h} + 17.5[\textit{hours}] \times 12[\text{€/h}] = \textbf{4710€}$$

## 2. Materials, tools and services costs

The construction of the prototype designed in this thesis requires material that needs to be bought and tools to machine these materials into the final shape. If there are some complex operation that can't be done with the available machinery or the available ability with said machinery, some services will have to be hired.

- The aluminium cost for the caps and the casing has amounted to 30€.
- The steel cost for the nozzle has amounted to 8 €.
- The cost of the O-ring for the seals has amounted to 9€.

This gives a total material cost of:

$$\textbf{Material cost} = 48\text{€}$$

### 3. Energy costs

The power that the computer used to develop this thesis uses is  $135\text{ W}$ . As it has taken about  $300\text{ hours}$  of work to complete the work on the computer, the energy consumed during this time is  $40.5\text{ kWh}$ . In Spain, the average price of electricity is about  $0.123\text{ €/kWh}$  [1]. That means that the cost of the energy used for the design and all the rest of the work done in the computer has been:

$$\textbf{Energy costs} = 40.5\text{ [kWh]} \times 0.123\text{ [€/kWh]} = \textbf{4.98 €}$$

## 4. Final costs

The project has involved several hours of work, both in the design phase and during the fabrication of the prototype. This amounts to almost all of the costs of this thesis. The costs regarding the material amounts to around 100 times less money, while the energy costs are even an order of magnitude less. All in all, the final cost of the thesis is here summarised:

Concept	Cost
Labour cost	4710 €
Material cost	48 €
Energy costs	4.98 €
<b>Total costs</b>	<b>4762.98 €</b>

*Table 1: Final costs of the thesis.*

## References

- [1] Selectra, “tarifasgasluz.com,” 1 January 2019. [Online]. Available: <https://tarifasgasluz.com/faq/precio-kwh>. [Accessed 16 June 2019].